Wisconsin Highway Research Program
Request for Proposal for

Critical Factors Affecting Asphalt Concrete Durability

Questions regarding the content of this RFP are due no later than
4:30 PM (CST), Monday, December 10, 2012

Responses to questions will be posted to the WisDOT Research and Library website (http://wisdotresearch.wi.gov/rfps-and-proposals) by
4:30 PM (CST), Monday, December 17, 2012

Proposers must submit an electronic version of a proposal (Adobe PDF required) by
4:30 PM (CST), Friday, January 25, 2013
to apakes@sustainability.wisc.edu

For further information regarding this RFP contact
Angela Pakes Ahlman
email: apakes@sustainability.wisc.edu

Researcher Questions on RFP

Please refer all questions on this RFP to the WHRP Technical Director, Angela Pakes Ahlman by the aforementioned due date. Questions must be in writing. No response will be provided to questions received after the due date.

Researcher Proposal Preparation Guidelines

WHRP Proposal Guidelines are available on the WisDOT Research and Library website (http://wisdotresearch.wi.gov/wp-content/uploads/WHRP-RFP-Guidelines-11-26-12.pdf). Please refer to these instructions in preparation of your response.

Wisconsin Highway Research Program
Request for Proposal

Critical Factors Affecting Asphalt Concrete Durability

I. Background and Problem Statement

The WisDOT evolution of asphalt concrete mix design from the Marshall method to the current SuperPave practice during the late 1990s was intended to further enhance actions addressing concerns over the rutting resistance of the materials. While WisDOT has largely been successful in achieving rut-resistant mixes, more recent issues pertaining to durability have been raised. Distresses such as cracking and raveling have been observed, and measures have already been taken by WisDOT to address this under the hypothesis that low voids in the mineral aggregate (VMA) might be the cause. However, due to the complex nature of asphalt concrete, there are many factors that affect its durability, and a more comprehensive and definitive investigation needs to be performed in order to identify and assess the most critical factors.

II. Objectives

The objective of this study is to apply the findings from an investigation of critical factors determining asphalt durability to support revisions to specifications and associated guidance documents. Ultimately, it is intended that these revisions will lead to the improvement of the durability-related performance of Wisconsin's asphalt paving materials. A brief search of current work on this topic reveals a number of recommendations, for example:

- Decrease the target air void content
- Decrease design gyration level
- Increase minimum VMA
- Reduce allowable recycled asphalt content
- Decrease the low-temperature performance grade of the asphalt binder
- Increase pavement thickness to reduce cracking

Numerous other recommendations have also been made. The main focus of this research may not necessarily be to discover new methods of improving durability, but rather to perform a detailed analysis of the impact of these types of recommendations. Each recommendation should include a quantified effect that is supported by test data, along with any potential cost impacts in order to help the department make value-based decisions that optimize available funding.

III. Scope of Work

a) **Task 1: Synthesis of Current Research**

i) **Literature Review**

Provide an initial assessment of factors affecting the durability of asphalt concrete based on current research. These factors should include (but are not limited to):

- Asphalt content

- Asphalt performance grade
- Asphalt oxidation
- Recycled asphalt content
- Nature of recycled asphalt (e.g. RAP vs. RAS)
- Volumetric properties (e.g. VMA, target air void content)
- Design gyration level
- Gradation characteristics
- Permeability characteristics
- Cracking resistance, thermal & fatigue
- Review of as-built construction data (e.g. thickness, density)

The researchers should note that the intent of this work is to evaluate material properties as opposed to construction practices. It is widely known that increasing in-place density improves performance, but the scope of this project is to remain largely focused on affecting material properties before they reach the field. However, a review of as-built construction data should also be performed in order to verify that design parameters are being met in the field (such as thickness and density). The researcher will work with the TOC to identify a select number of DOT projects with a balance of satisfactory and unsatisfactory performance.

Additionally, an assessment of current test methods to determine asphalt concrete durability should be performed. There are many practices, procedures, and equipment currently being utilized to determine durability, but due to the broadness of the subject, there are too many methods to fit within the scope of a single study. Benefits and limitations of each should be addressed, with specific attention paid to the applicability of the each method to Wisconsin's needs and practices. This will allow the researcher to determine a manageable number of test methods to be incorporated into the subsequent laboratory evaluation task.

ii) **Summary and Comparison to Current WisDOT Practice**

(1) Review WisDOT specifications and guidance documents to define current WisDOT mix design and quality management program practices that affect asphalt concrete durability.

(2) Evaluate literature review findings for compatibility with WisDOT guidance and identify opportunities for potential revisions to specifications and application guidelines.

b) **Task 2: Work Plan Development**

i) **Laboratory Evaluation**

Develop a laboratory testing plan to address the opportunities identified in comparison of WisDOT practice to the literature review findings. The work plan will include but is not limited to the following:

(1) Detailed Scope of Work: Identify shortcomings in current WisDOT practice and define the testing methods and evaluation criteria that will be used to address these needs. Specifically identify and justify both the critical material properties that will be measured, as well as the testing methods used to assess material durability.

(2) Materials Selection: Define materials sampling needs in terms of both field-produced mix and raw materials to complete the project. Identify potential sources of asphalt binder and aggregate. All materials will be relevant to paving in Wisconsin. The Project Oversight Committee (POC) will assist the researcher in this activity through providing state

approved mix designs (where applicable) and contact information to coordinate material sampling.

(3) Experimental Design: Present an experimental design for evaluation of the critical factors determining asphalt concrete durability to generate supporting data for potential specification changes.

c) **Task 3: Interim Presentation and Project Memorandum**

i) Present findings from Task 1 and the proposed laboratory work plan to the Technical Oversight Committee (TOC). The presentation should include justifications for the properties to be investigated and test methods to be employed.

ii) Include a project memorandum briefly summarizing the work performed in Tasks 1 & 2, to be submitted prior to the interim presentation.

iii) The TOC will provide any feedback and guidance to the researcher regarding the work plan after the presentation. Upon plan approval by the TOC, the researcher will then be given clearance to move on to Task 4.

d) **Task 4: Execution of Work Plan and Analysis of Results**

All materials testing will use standardized test methods (ASTM/AASHTO) or tests that have yet to be standardized but are accepted as current practice in the HMA community.

e) **Task 5: Project Deliverables**

i) Draft Final Report: The researcher is responsible for submitting a draft final report to the TOC. Conclusions and recommendations will specifically address WisDOT efforts to improve asphalt concrete durability through enhanced mix design practice and/or quality management program improvements. Any changes to existing practice should be addressed using the afore-mentioned value-based approach in an effort to balance performance and cost.

ii) Specific Results, Findings, Tools, etc.

(1) Revised WisDOT specification recommendations and/or guidance documents

(2) Cost-benefit analysis of the proposed revisions to WisDOT specifications to address durability of asphalt concrete.

(3) Presentation Requirements: All projects require the PI to give a closeout presentation after submittal of the draft final report (inclusive of a "visual" production, e.g. a summary PowerPoint presentation).

(4) Final Report. Electronic copy in PDF format and eight hard copies delivered to WHRP by the contract end date.

f) **Task 6: Final Report and Project Closeout Activities**

i) Project Closeout Presentation: The researcher will present findings and recommendations to the TOC. The TOC will supply/document any comments or concerns regarding the final product of the research.

ii) Final Report: The researcher is expected to address or incorporate any TOC comments prior to delivery of the final report in WHRP format.

IV. <u>WisDOT/TOC Contribution</u>

a) Expected level of involvement by Staff/TOC Members: 40 hours maximum.

b) WisDOT Equipment
   (1) Researchers should not assume availability of WisDOT equipment in the proposal. If equipment is donated to the project by WisDOT or another entity, a letter of commitment must be included in the proposal.

V. Other Project Requirements

a) Laboratory/Technician Certifications
   i) HTCP or Equivalent Mix Designer (Trained and/or Certified) as part of the research team.
   ii) HTCP or Equivalent Laboratory Technician(s) trained or certified to conduct proposed laboratory testing.
b) Travel
   i) Required travel to fulfill TOC Obligations: Minimum of one on-site meeting.

VI. Budget and Time Frame

a) Project Duration: 18 months, with a final review period of three months (prior to the project end date) for a total of 21 months (**August 2013 – April 30, 2015**).
   i) Project is considered "closed" upon receipt of the final report (refer to Sec III, Task 6).
b) Project Budget: Not to exceed **$175,000** and shall include any costs associated with performing tests, analyzing data, preparing and presenting the draft and final reports.

VII. Implementation

a) General areas of WisDOT specifications and practices this research has potential to impact:
   i) Specifications: **Standard Specifications Sections 450, 455, & 460**
   ii) Guidance documents: **Construction & Materials Manual Sections 8-36 & 8-65**
b) Researcher is expected to communicate the following:
   i) Potential changes in current specification language and guidance documents.
   ii) Benefits in terms of performance and cost savings.
   iii) Tools to facilitate implementation.

Results of this study will provide WisDOT support data and a comparative analysis intended to improve the durability of its asphaltic mixtures. The department will then take the responsibility to move appropriate recommendations through its pertinent Technical Teams, and Advisory Panels for continued implementation activities.